acted independently of the current from the trolley-wire, a fact quite sufficient to account for him attempting to apply the magnetic brake when the wheels were skidded. In regard to the hypothesis that the accident was due to improper fitting of the hand brakes, Colonel Yorke says that the shoes, which cleared the wheels 1/16th of an inch, as stated, were new and of cast-iron. The rubbing surface would therefore have the rough skin characteristic of iron castings, and friction would be greater than when the blocks had been worn smooth by use. A very slight pressure would cause the wheels to skid, and as the springs which pull the brake off had only 1/16th inch compression, the brake might remain on after the driver had moved the brake lever to the release position. The position of the brake blocks, in regard to the vertical component, may also have had an effect in keeping them on, as Colonel Yorke points out in his report. The blocks were hung so that they would be below the centre of the wheels, and therefore the upward movement of the periphery of one wheel in each pair would tend to force the brake on when once it had made contact. Colonel Yorke very properly condemns this arrangement, as it prevents the brakeman from using any nice adjustment such as is needed to prevent the wheel from skidding. Sir Douglas Galton, in his paper before the Institution of Mechanical Engineers, recommends half an inch clearance between the wheels of a railway coach and the brake blocks, and it is usual in railway practice to place the blocks level with the wheel centres, or somewhat higher. The nice adjustment of control needed for working hand brakes efficiently, especially when rails are greasy, and therefore easily skidded, is hardly possible with brake rigging such as was used. The transmission was by a chain wound upon a spindle and through a series of rods and levers, "often roughly shaped to size and length in a forge, and connected by ill-fitting pins and joints, or by short lengths of chain," as the Board of Trade report states. It is easy to understand that lost motion, due to such rigging, would account for a good deal of lag even if the gear were new.

AN EDUCATIONAL GAP.[1]

FOR many years past the attention of those who have been giving serious consideration to the complex educational problems which arise in this country has been directed to the gap which exists between the time at which pupils ordinarily leave the public elementary schools and that at which a very small proportion of them appear as students at our technical institutions and at various evening classes. Many attempts have been made to bridge over this gap by continuation classes of various kinds and under various conditions, but these attempts cannot be said to have been successful in the past to any extent commensurate either with the importance of the problem or with the amount of care which has been bestowed upon it. The causes of failure are deeply rooted in our social and economic organisation, whether we consider the large towns, the country districts, or the intermediate districts which are partly urban and partly rural. In the large towns, for instance, as soon as a lad is released from compulsory attendance at school, either by age or by the attainment of the necessary standard, his services have a market value which his parents are usually very unwilling to forego, though its immediate sacrifice may have an important effect upon the ultimate success of the youth in after life. The consequence is that, especially in London, large numbers of these boys take positions as van boys, errand boys, and in similar occupations, in which for a few years they can earn wages up to or exceeding 10*s.* per week. By the time, however, that they reach the age of eighteen or nineteen they cease to be eligible for such work, and, not having utilised the intervening years since leaving school in attaining expertness in any skilled occupation, there is no other course open to them but to join the ranks of unskilled labour, whence the step to those of the unemployed and unemployable is easy, especially as they have reached the age at which their parents can no longer be expected to contribute to their maintenance. In the country, other causes lead to somewhat similar final results.

The inquiry of the consultative committee deals in great detail with one series of suggestions and experiments for bridging this gap for a minority of the pupils referred to. The particular problem minutely examined is that of providing slightly "extended facilities" (in a secular sense) for the best pupils, who would otherwise leave the elementary schools at the usual age of fourteen years or earlier, and whose parents would be subjected to the temptations mentioned above. The question inquired into is how best to establish a type of school capable of educating such children, the parents being willing to maintain them for the necessary time, to a somewhat higher standard without trenching on the proper province of the secondary schools, on the one hand, or of the training which prepares specifically for a definite career on the other.

The problem is one well suited for the consideration of the consultative committee on account of the wide and varied educational experience of its different members. To strengthen its hands, and to obtain the necessary information which might not be available within the four corners of its own membership, it has examined a carefully selected number of representative official and non-official witnesses, twenty-five in all. For obvious reasons the names of the official witnesses are withheld, and therefore no names whatever are given; nor is the evidence published in full, but ample quotations are made from it wherever they are deemed necessary and relevant to support the arguments of the report. The only criticism one has to make upon the selection of the witnesses is that so few as five employers of labour can scarcely have had sufficiently varied individual experience to supply materials for dealing with so large a problem.

That the present is a time of transition and experiment, and that the points of view from which educational problems are being attacked are rapidly changing, could receive no greater exemplification than is conveyed by this report. The gradual change of the official attitude towards such problems has been very apparent to outside observers during the last four or five years in the different reports, prefatory notes to codes, and other official publications issued by the Board of Education from time to time. This report deals in full detail with numerous points brought into view by the new standpoints, and it is to be hoped that the conclusions of the committee on these and cognate matters may be fully adopted by the Board in shaping its policy, without, however, rushing into opposite extremes.

The swing of the pendulum from the time when "payment by results" was the fashionable official system has indeed been great, and every page of this report bears evidence of the distance which has been travelled from those "dark ages." In point of time, however, the period referred to is sufficiently close to have left a legacy, which forms a factor in the present problem, in the shape of a body of teachers some of whom still find it difficult to realise that they are "freed from the trammels they have been accustomed to all their lives," and who have "a certain stock-in-trade which they think can be used anywhere."

The chief value of the report consists in the recognition, and some of the consequences of that recognition, of the proper function of education, in the root sense of the word, as a training of the moral qualities, the formation of habits of mind being regarded as more important than the acquirement of mere knowledge. Prominence is given to the importance of the development of self-activity and resource and powers of observation, the fostering of intelligence and interest in the work, and that training of the eye and the hand in conjunction with the brain which leads to "general handiness." These are some of the points dwelt upon, not once or twice, but many times and in varied aspects, in the pages of the report.

The report also puts its finger upon some of the most glaring defects of the present and previous systems of education, both elementary and secondary. The results, which have long been painfully evident to those who in any form have been entrusted with the further education of the pupils turned out, are that these pupils have not

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[1] Report of the Consultative Committee upon Questions affecting Higher Elementary Schools. (Adopted by the Committee May 24, 1906, and issued, with a Prefatory Note, by the Board of Education, July 20, 1906.)

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been taught "how to learn," that they are deficient in resource, in self-help, in curiosity of the right kind. In the majority of cases they are quite incapable of thinking for themselves, and in a large number of cases they cannot express their ideas, if they have any, in simple English. Such consequences necessarily follow from the old bad system of "payment by results" in the elementary schools, and from obsolete and defective methods of teaching, coupled with the worship of examinations, in the secondary schools.

The type of school proposed for filling the "gap," under whatever name it may be known, is one which aims at taking the best children of the elementary schools sufficiently early in their career to enable them to reach a somewhat higher standard of attainment than is aimed at in the elementary schools themselves. For good reasons, which are set forth in the report, the age at which the change from the elementary school should be made is considered by the committee to be not less than twelve years. At this age the best pupils of the schools, selected by some simple qualifying examination combined with reports from the head teachers, are to be drafted into the new type of school. In this school the length of the course is to be three years, so that the pupils should remain there until they are fifteen years old. To ensure this, it is felt that the parents of all pupils so transferred should be put under a moral obligation to maintain them at the school until the completion of the period, though it is recognised that it is not practicable to make the obligation a binding one in the legal sense.

The curriculum in the new type of school will differ within certain limits according to the needs of the locality in which it is placed, being different for (*a*) country districts, (*b*) the smaller towns of 20,000 to 50,000 inhabitants, and (*c*) large towns. Whilst specialised instruction such as is proper to the technical institute or the trade school is excluded, the aim of the school, in whichever of the above environments it may be placed, is to prepare the pupils more thoroughly for their life-work. Speaking generally, the curriculum is to consist (1) of what are usually classed as humanistic subjects; (2) of scientific and mathematical subjects; and (3) of manual instruction, with some physical training. In the humanistic section the English language and literature is to form the basis of the instruction, it being recognised that it is not possible to teach a foreign language effectively under the conditions, and Latin is of course excluded. History and geography are taken as subdivisions of the main subject. Class singing and religious instruction come under the same section, to which, on the whole, about one-third of the teaching time is to be devoted. In the scientific and mathematical subjects are included arithmetic, algebra, and the principles of geometry, all as applied to practical calculations; account keeping, as distinct from book keeping; graphical methods of calculation, mensuration, and elementary natural science, with experimental work done by the pupils and varied according to the environment. To this group of subjects another third of the time is to be given. The manual instruction includes, for boys, general wood and metal work, treated from an educative standpoint, and aiming at the training of hand, eye, and brain; in addition there is definite instruction in drawing of the non-professional kind, machine drawing, for instance, being excluded. For girls this manual instruction is replaced by training in domestic subjects and housecraft. Finally, about two hours per week are to be devoted regularly to physical training, which, of course, will differ, not only as between boys and girls, but also in different localities.

One great difficulty in carrying out this scheme is that of obtaining the right kind of teachers. It is insisted upon more than once that what is important is the method of teaching rather than the matter. The ideal teacher, it is pointed out, should be a man of character and ability, with freshness of mind, thoroughly alive to the environment, and thoroughly sympathetic with his pupils; he should be quite free from the old trammels which grew up in the dark ages referred to above, in which it will be remembered that the teacher who wished to rise to the higher posts in his profession was encouraged to pile certificate upon certificate in a great variety of subjects, in few, if any, of which, as results showed, was he really qualified to teach. Suggestions are made as to the training of these teachers, some of which appear to the writer not to be very practicable, more especially the suggestion that the teachers should spend one year in actual workshops. Apart from the difficulty of getting employers to be bothered with such men in their factories, the writer is of opinion that the year could be far more profitably employed in other directions, as the smattering obtained by so short an experience and so limited a view of commercial life is apt to be more harmful than useful. It is important to notice that the report emphatically recognises that for special technical subjects special teachers are required; but then these subjects are ruled out of the curriculum of the schools under consideration, and, indeed, such subjects as shorthand, machine drawing, book-keeping, industrial chemistry, and typewriting, some of which even modern schoolmasters are often inclined to view with favour, are set aside as unsuitable in any scheme of general education, whether secondary or elementary.

Considerations of space will not allow us to dwell upon many other important matters of detail which are handled in a masterly manner in this valuable report; suffice it to say in conclusion that it will well repay careful study, and certainly ought to be perused by everyone who is interested in the rapid developments which are taking place in the educational world.

R. M. W.

ELECTRIC TRAMWAYS.

THE leading feature of the current issue (No. 180, vol. xxxvii.) of the Journal of the Institution of Electrical Engineers is the paper on the overhead equipment of tramways by Messrs. R. N. Tweedy and H. Dudgeon, especially in view of the fact that the overhead system has been so abused of late years by the general public, and thousands of pounds sunk in other schemes of electric tramways which might have been enormously reduced if the prejudice which exists against the overhead system on account of its supposed "danger" had been removed. The authors throughout the paper make a strong appeal for more economy in the capital outlay of tramway equipment, and show how in their opinion this may be brought about in the case of the overhead system.

Dealing with the size of pole to be employed, the authors are strongly of the opinion that we err seriously on the side of using too heavy and too strong poles, straining them too much, and consequently having larger span wire and more concrete for fixing than is necessary. Also they would do away with the usual cast-iron bases which protect the poles, as being not only a waste of money—being unnecessary—but also an actual source of danger, in that they prevent the pole within them from being painted when the outer portions are done—unless the box is lifted, a costly process—and allow water to accumulate inside the case which causes the pole to rust badly.

The same remarks apply to the collars which it is customary to place round the joints in the poles, and water is liable to do much damage here also. If the bases are not done away with they must be ventilated and drained, so as to prevent the accumulation of water from sweating. The collars also must be drained properly. More economy is to be brought about in the trolley-wire itself, as in the authors' opinion too large a section is now being used, and they think that from 56*l.* to 80*l.* per mile may be saved on this charge alone. Again, referring to the "hangers," the authors strike out strongly for the use of malleable iron in place of bronze and gun-metal fittings, which are so dear to some engineers—and are also dear in price as compared with malleable iron properly galvanised.

No local action takes place—with the malleable iron hanger—between the span wire and hanger as is the case with bronze hangers, and from experience iron hangers have been found to last longer than bronze or brass ones, though the oxidation of the iron bolts is one of the difficulties attendant on the overhead system. The authors suggest three methods of overcoming the difficulty:—

(*a*) The insertion of a shield between trolley-wire ear and the hanger to prevent the trolley wheels throwing

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